



## Preliminary Report – URS Soil Samples 8/6/01

**Sample Description:** Samples consisted of dry surface soil. The soil appeared to be taken from an area that at one time was wet, which then dried forming characteristically "scalloped"-shaped surface.


**Sample Preparation:** Ten randomly selected 1 gram aliquots of the soil from each of the sample bottles were taken. Each aliquot was gently ground to a fine powder using an agate mortar and pestle. The powdered aliquots from each bottle were re-combined in a glass vial and extracted twice with 20mL of methylene chloride. The extraction solvent was removed and evaporated under a stream of nitrogen to a volume of 200  $\mu$ L and then transferred to gas chromatography vial fitted with a 350- $\mu$ L limited-volume insert. An analytical blank was prepared by evaporating 20 mL of methylene chloride to 200  $\mu$ L.

**Sample Analysis:** The extracts from samples bottles labeled M-1 and M-2 were analyzed by full scan GC/MS. The resultant chromatograms contained a number of small peaks most of which were not identified as their spectra did not match any of the 75,000 spectra in our spectral library. However, one of the peaks was identified as 2-chlorobenzaldehyde, one of the precursors used in the manufacture of CS agent. This compound was found in both samples and was absent from the analytical blank.

**Semi-Quantitative Measurements:** A standard of 2-chlorobenzaldehyde was prepared at a level of 1.0 ng/ $\mu$ L and analyzed by selective ion monitoring using the ions 139, 111, and 76. The area under the resultant 2-chlorobenzaldehyde peak was measured. The two extracts from samples M-1 and M-2 were similarly re-analyzed and the 2-chlorobenzaldehyde peak areas were measured. By comparing the area of the standard to areas of the samples, it was determined that the soil samples contained approximately 3ng of 2-chlorobenzaldehyde per gram of soil (3ppb). Malononitrile and CS were not present in the samples.

**Additional Observations:** A bottle of 2-chlorobenzaldehyde was opened and held at distance from the nose. The resultant odor was very much like a scented candle or scented oil. As bottle was brought nearer, the odor became pungent and nasally irritating. The international safety card for this chemical is attached.

**A note regarding the chemistry of CS:** CS is produced by reacting 2-chlorobenzaldehyde with malononitrile. After CS released into the atmosphere it undergoes a slow hydrolysis with moisture in the air and is converted back to its original constituent precursors, 2-chlorobenzaldehyde and malononitrile. Therefore, it is very unlikely to find CS, itself, in soils after more than a few days from initial exposure.

  
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